Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims

1. (Currently Amended) An actuator device comprising:

a spine member having a length;

a first plate and a second plate, the first plate fixed to the spine member at a first location along the length of the spine member and the second plate fixed to the spine member at a second location along the length of the spine member, wherein the second location is spaced from the first location; and

a first actuator positioned between the first plate and the second plate for selectively creating a push and/or pull force between the first plate and the second plate to change the orientation of the first plate relative to the second plate, the first actuator includes a first array of electrostatically actuated unit cells, wherein at least some of the electrostatically actuated unit cells are actuated from an expanded state to a closed state in response to an applied electric potential, and wherein at least some of the electrostatically actuated unit cells include:

a first flexible member having a first electrode; and

a second flexible member having a second electrode, wherein the first flexible member is attached to the second flexible member at selected spaced locations, wherein the first flexible member is pulled toward the second flexible member when the electric potential is applied between the first electrode and the second electrode.

2. (Original) The actuator device of claim 1 further comprising a second actuator positioned between the first plate and the second plate for selectively creating a push and/or pull force between the first plate and the second plate to change the orientation of the first plate relative to the second plate.

3. (Original) The actuator device of claim 2 wherein the first actuator is positioned in a first region between the first plate and the second plate, and the second actuator is positioned in a second region between the first plate and the second plate, wherein the first region is separate from the second region.

4. (Original) The actuator device of claim 3 wherein the spine member passed between the first region and the second region.

5. (Original) The actuator device of claim 2 further comprising:

a third actuator positioned between the first plate and the second plate for selectively creating a push and/or pull force between the first plate and the second plate to change the orientation of the first plate relative to the second plate;

a fourth actuator positioned between the first plate and the second plate for selectively creating a push and/or pull force between the first plate and the second plate to change the orientation of the first plate relative to the second plate.

6. (Original) The actuator device of claim 5 wherein the first actuator, the second actuator, the third actuator and the fourth actuator are positioned in separate regions between the first plate and the second plate.

7. (Original) The actuator device of claim 6 wherein the separate regions are selectively spaced around the spine member.

8. (Original) The actuator device of claim 7 wherein the separate regions are disposed symmetrically about the spine member.

9. (Original) The actuator device of claim 8 wherein each of the separate regions correspond to one of four quadrants about the spine member.

10. (Original) The actuator device of claim 1 wherein the spine member bends when the orientation of the first plate is changed relative to the second plate.

11. (Cancel) The actuator device of claim 1 wherein the first actuator includes a first array of electrostatically actuated unit cells.

12. (Cancel) The actuator device of claim 11 wherein at least some of the electrostatically actuated unit cells are actuated from an expanded state to a closed state in response to an applied electric potential.

13. (Cancel) The actuator device of claim 11 wherein at least some of the electrostatically actuated unit cells include a through hole for reducing fluidic dampening of movement of the unit cells.

14. (Cancel) The apparatus of claim 12 wherein at least some of the electrostatically actuated unit cells include:

a first flexible member having a first electrode;

a second flexible member having a second electrode, wherein the first flexible member is attached to the second flexible member at selected spaced locations, wherein the first flexible member is pulled toward the second flexible member when the electric potential is applied between the first electrode and the second electrode.

15. (Currently Amended) A flexible member comprising:

a spine member having a length;

~~two~~ three or more plates attached at spaced locations along the length of the spine member, selected plates forming a plate pair, at least some of the plates extending out and forming ribs that support an outer skin of the flexible member; and

one or more actuators positioned between and fixed to at least selected plate pairs for creating a push and/or pull force between the corresponding plate pair and to change the relative orientation of the plate pair.

16. (Currently Amended) The flexible ~~arm~~ member of claim 15 wherein each of the one or more actuators includes an array of flexible unit cells capable of actuating from an expanded state to a closed state in response to an applied electric potential.

17. (Currently Amended) The flexible ~~arm~~ member of claim 16 further comprising a controller for selectively controlling the actuation of the one or more actuators to create a desired motion of the flexible ~~arm~~ member.

18. (Cancel) The flexible member of claim 15 further comprising an outer sheath sized to fit over the two or more plates, the outer sheath being adapted so that in a first direction along the length of the spine member the outer sheath has a first resistance to sliding motion, and in an opposite direction along the length of the spine member the outer sheath has a second resistance to sliding motion, the first resistance to sliding motion being greater than the second resistance to sliding motion.

19. (Original) The flexible member of claim 15 further comprising one or more sensors for sensing one or more environmental conditions in the vicinity of the flexible member.

20. (Original) The flexible member of claim 19 further comprising a transmitter adapted to transmit signals related to data captured by the one or more sensors.

21. (Original) The flexible member of claim 17 further comprising a receiver for receiving commands and for providing the commands to the controller.

22. (Cancel) The flexible member of claim 16 wherein at least selected plates are printed circuit boards.

23. (Cancel) The flexible member of claim 15 further comprising one or more intervening plates positioned between a selected plate pair.

24. (Cancel) The flexible member of claim 23 wherein the one or more intervening plates include one or more relief structures that provide a path for the one or more actuators that extend between the selected plate pair.

25. (Original) The flexible member according to claim 15 wherein each of the two or more plates define a major surface, wherein the spine member intersects and is attached to the two or more plates near the center of the major surface.

26. (Original) The flexible member according to claim 15 wherein each of the two or more plates define a major surface, wherein the spine member intersects and is attached to the two or more plates at a location that is offset from the center of the major surface.

27. (Original) The flexible member according to claim 15 wherein each of the two or more plates define a major surface, wherein the spine member intersects and is attached to the two or more plates at or near an edge of the major surface.

28. (Original) A flexible member, comprising:

an elongated body;

one or more electrostatically actuated actuators positioned at selected locations along the length of the elongated body, the one or more electrostatically actuated actuators, when activated, change the shape of the flexible member; and

a controller for controlling the one or more electrostatically actuated actuators.

29 (New) An actuator device comprising:

a spine member having a length;

a first plate and a second plate, the first plate fixed to the spine member at a first location along the length of the spine member and the second plate fixed to the spine member at a second location along the length of the spine member, wherein the second location is spaced from the first location;

a first actuator positioned between the first plate and the second plate for selectively creating a push and/or pull force between the first plate and the second plate to change the orientation of the first plate relative to the second plate, wherein the first actuator includes a first array of electrostatically actuated unit cells, wherein at least some of the electrostatically actuated unit cells include a through hole for reducing fluidic dampening of movement of the unit cells.

30. (New) A flexible member comprising:

a spine member having a length;

two or more plates attached at spaced locations along the length of the spine member, selected plates forming a plate pair;

one or more actuators positioned between and fixed to at least selected plate pairs for creating a push and/or pull force between the corresponding plate pair and to change the relative orientation of the plate pair; and

an outer sheath sized to fit over the two or more plates, the outer sheath being adapted so that in a first direction along the length of the spine member the outer sheath has a first resistance to sliding motion, and in an opposite direction along the length of the spine member the outer sheath has a second resistance to sliding motion, the first resistance to sliding motion being greater than the second resistance to sliding motion.

31. (New) A flexible member comprising:

a spine member having a length;

two or more plates attached at spaced locations along the length of the spine member, selected plates forming a plate pair, and wherein at least selected plates are printed circuit boards; and

one or more actuators positioned between and fixed to at least selected plate pairs for creating a push and/or pull force between the corresponding plate pair and to change the relative orientation of the plate pair.

32. (New) The flexible member of claim 31 wherein at least selected printed circuit boards have one or more traces that are electrically coupled to at least one of the actuators to provide one or more control signals to the at least one actuator.

33. (New) A flexible member comprising:

a spine member having a length;

two or more plates attached at spaced locations along the length of the spine member, selected plates forming a plate pair;

one or more actuators positioned between and fixed to at least selected plate pairs for creating a push and/or pull force between the corresponding plate pair and to change the relative orientation of the plate pair; and

one or more intervening plates positioned between a selected plate pair.

34. (New) The flexible member of claim 33 wherein the one or more intervening plates include one or more relief structures that provide a path for the one or more actuators that extend between the selected plate pair.

35. (New) An actuator device comprising:

a spine member having a length;

a first plate and a second plate, the first plate fixed to the spine member at a first location along the length of the spine member and the second plate fixed to the spine member at a second location along the length of the spine member, wherein the second location is spaced from the first location, and wherein the spine member is a unitary member with no pivot joints; and

a first actuator positioned between the first plate and the second plate for selectively creating a push and/or pull force between the first plate and the second plate to change the orientation of the first plate relative to the second plate.